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Patterns of Prostate-Specific Antigen Test Use in the U.S., 2005–2015

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Abstract

Introduction: Recommendations for prostate-specific antigen-based screening for prostate cancer are placing increasing emphasis on men aged 55–69 years. The goal of the current study is to describe patterns of population-based prostate-specific antigen testing with details about that age group.

Methods: National Health Interview Surveys from 2005 to 2015 were analyzed in 2017 to estimate routine prostate-specific antigen testing in the past year from self-reported data by age group (40–54, 55–69, ≥70 years), and also by risk group, defined as African American men or men with a family history of prostate cancer versus other men. Differences between successive survey years by age and risk groups were assessed by predicted margins and rate ratios with 99% CIs, using logistic regressions.

Results: Prostate-specific antigen testing among men aged 55–69 years decreased from a high of 43.1% (95% CI=40.3, 46.1) in 2008 to a low of 32.8% (95% CI=30.8, 34.7) in 2013, with no significant change in 2015 at 33.8% (95% CI=31.3, 36.4). Men aged ≥70 years had consistently high prevalence in all survey years, ranging from 51.1% in 2008 to 36.4% in 2015. African American men, men with a family history of prostate cancer, and other men showed a 5% absolute decrease over time, but this reduction was significant only in other men.

Conclusions: Despite decreases, the absolute change in prostate-specific antigen testing for men aged 55–69 years was small (9.3%) over the study period. Men aged ≥70 years, for whom the benefits are unlikely to exceed the harms, continue to have consistently high testing prevalence.

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SUPPLEMENTAL MATERIAL

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INTRODUCTION

Recommendations for prostate-specific antigen (PSA)-based screening for prostate cancer are placing increasing emphasis on men aged 55–69 years.[1,2] In 2013, the American Urological Association recommended shared decision making for men aged 55–69 years.[1] In 2017, the U.S. Preventive Services Task Force (USPSTF) released draft recommendation updates for review and comment. The USPSTF draft recommends that clinicians inform men aged 55–69 years about the potential benefits and harms of PSA-based screening for prostate cancer.[2]

The current study describes patterns of population-based PSA testing from 2005 to 2015 with special emphasis on the group aged 55–69 years. In addition, the current study stratifies trends by two prostate cancer risk groups, defined as African American men or men with a family history of prostate cancer (AA/FH) versus other men (NAA/NFH).

METHODS

The National Health Interview Survey is an annual, in-person, cross-sectional, nationally representative survey that monitors health trends over time.[3] Questions about PSA testing were included in 2005, 2008, 2010, 2013, and 2015. Final response rates for the adult samples for those years were 69.0%, 62.6%, 60.8%, 61.2%, and 55.2%, respectively. Men aged ≥40 years were asked questions about their most recent PSA test and the main reason for testing. The study outcome was based on self-reported PSA testing in the past year as part of a routine exam. Men reporting other reasons, a history of prostate cancer, or with missing data on PSA testing were excluded. The final study sample included 35,326 men.

PSA testing estimates and their corresponding 95% CIs were calculated by three age groups (40–54, 55–69, and ≥70 years). The National Health Interview Surveys in 2008 and 2013 did not include detailed information on family history, limiting the AA/FH and NAA/NFH comparison to survey years 2005, 2010, and 2015.

Differences in prevalence between each survey year and its prior survey year were assessed by logistic regression models with predicted marginal probabilities after combining the data from those 2 years and calculating rate ratios (RR) and their 99% CI. The age group analysis was adjusted by race, and the risk group analysis was adjusted by age and race. All analyses were performed in 2017 using SUDAAN, version 10, to account for the complex sampling design and for nonresponse.

RESULTS

Appendix Table 1 (available online) shows unadjusted characteristics of men who reported routine PSA testing in the past year by survey year. PSA testing was highest among college graduates and lowest among men with less than a high school education.

After an increase from 2005 to 2008, the unadjusted overall reported routine PSA testing decreased steadily from 30.9% in 2008 to 23.6% in 2013, and remained stable in 2015. This pattern was observed in all age groups (Figure 1; Table 1). PSA testing in men aged 55–69

years decreased by 10.3% from 2008 to 2013, with the highest decline occurring from 2010 (40.8%, 95% CI=38.4, 43.4) to 2013 (32.8%, 95% CI=30.8, 34.7).

PSA testing was consistently high among men aged ≥70 years in each survey year, ranging from 51.1% in 2008 to 36.4% in 2015. Men aged 40–54 years had the lowest PSA testing in each survey year, ranging from 17.7% in 2008 to 11.1% in 2013. Adjusted analyses were similar in all age groups with significant decrease in PSA testing from 2010 to 2013 among men aged 55–69 years (RR=0.8, $p<0.001$); a significant decrease from 2008 to 2010 and from 2010 to 2013 among men aged 40–54 years (RR=0.8 and RR=0.79, $p<0.01$, respectively), but not significant among men aged ≥70 years.

In the cancer risk group analysis, AA/FH men had significantly higher routine PSA testing than NAA/NFH men in 2005 (34.1% vs 27.8%, $p<0.001$) and in 2015 (28.6% vs 23.1%, $p<0.001$) (Figure 2; Table 2). PSA testing among AA/FH men declined from 2005 to 2015 from 34.1% (95% CI=31.2, 37.1) to 28.6% (95% CI=25.8, 31.5). A significant decrease occurred from 2010 (28.8%, 95% CI=27.4, 30.3) to 2015 (23.1%, 95% CI=21.7, 24.5) among NAA/NFH men only and was also observed in the adjusted analysis (RR=0.82, 99% CI=0.73, 0.90, $p<0.01$).

DISCUSSION

After several years of decreases in annual routine PSA testing across age groups and risk categories, PSA testing stabilized in 2015, but continued with high prevalence in men aged ≥70 years. One third of men aged 55–69 years and more than 12% of men aged 40–54 years, mostly at average risk, continued to report having annual, routine PSA testing in 2015. Testing men aged 40–54 years at average risk is potentially concerning because of the low prevalence of prostate cancer among these men. Furthermore, evidence demonstrates that if a net benefit exists, it is among men aged 55–69 years. These results suggest that improved information on the benefits and harms of PSA-based screening for prostate cancer is warranted, particularly in average-risk adults who are either younger or older than the age range suggested by most clinical practice guideline groups.

AA/FH men are at higher risk of prostate cancer, but have been underrepresented in most prostate cancer screening research.[2] As a result, the USPSTF and other groups have concluded that no evidence exists to provide a separate recommendation from those for the general population (Appendix Tables 2 and 3, available online).[1,2,4–16] This study's findings show a small decrease over the study period for both AA/FH and NAA/NFH, suggesting little difference in practice patterns.

This study's results show that PSA testing was most prevalent among men aged ≥70 years, an age group most often diagnosed with prostate cancer. However, there has been increasing recognition of overdiagnosis by identifying cases in a lower risk category that may not affect a patient's life expectancy.[2] In addition, PSA-based screening may result in unnecessary treatment associated with significant harms.[2] Prior versions of the USPSTF recommendation,[7,8] the 2017 USPSTF draft, and a number of other organizations currently recommend against PSA testing in men aged ≥70 years because the potential harms may

exceed the potential benefits (Appendix Tables 2 and 3, available online) or identify it as a measure to monitor service overuse.[15,16]

Despite recommendations for decision making[1,2] and a decrease in PSA testing, it is not clear what recommendations are being commonly followed in practice, and how patient values and preferences, and Medicare reimbursement for PSA screening,[13] might contribute to the observed patterns.

Limitations

The study limitations include missing years in the trend analysis of both the age and cancer risk groups, a reliance on self-reported PSA testing subject to recall bias,[17] underestimation of the results because an estimated one third of patients may receive PSA tests without their knowledge,[17] and the fact that the 2017 USPSTF recommendations are still a draft, and may be revised.

Strengths of the study include use of the most recent information on nationwide PSA testing, consistency with prior reports on PSA testing,[18–21] having detailed description about PSA testing in men aged 55–69 years emphasized in the 2017 draft USPSTF recommendations, and highlighting PSA-based screening overuse among men aged ≥70 years, thereby pointing out the need for prevention initiatives to decrease screening in this age group.

CONCLUSIONS

Despite decreases, the change in PSA testing for men aged 55–69 years was small over the study period. Men aged ≥70 years, for whom the benefits are unlikely to exceed the harms, continue to have the highest testing prevalence. Studies are warranted to assess how the changes in PSA screening recommendations affect detection, and the balance of potential benefits (reduced mortality and diagnostic) versus harms (overdiagnosis, diagnostic, and treatment complications).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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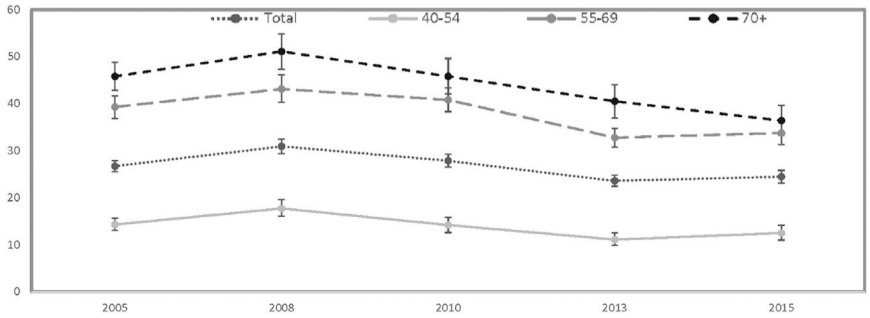

Figure 1. Estimated percentages of PSA testing in the past year by age group and survey year.

Note: Error bar shows 95% CI of the prevalence of PSA testing. Questions about PSA testing were not included in NHIS survey years 2006, 2007, 2009, 2011, 2012, and 2014. Percentages are weighted to the study population in the respective year.

NHIS, National Health Interview Survey; PSA, prostate-specific antigen.

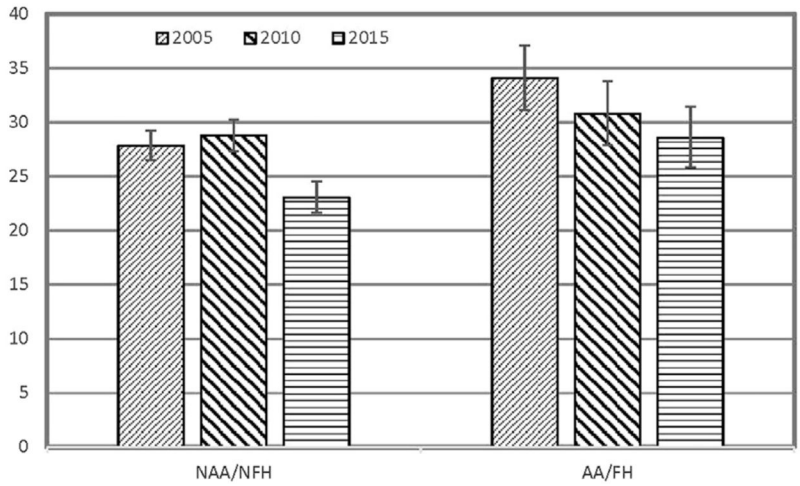

Figure 2. Estimated percentages of PSA testing in the past year by risk level and survey year.

Note: Error bar shows 95% CI of the prevalence of PSA testing. NHIS survey years 2008 and 2013 are not shown because family history was not collected in those years. Percentages are weighted to the study population in the respective year and are standardized to the 2010 Census estimated population.

AA/FH, African American/family history (higher risk); NAA/NFH, non-African American/no family history (average risk); NHIS, National Health Interview Survey; PSA, prostate-specific antigen.

Table 1.

Estimated Percentages of PSA Testing in the Past Year and Adjusted Rate Ratios by Age Group and Survey Year

	2005		2008		2010		2013		2015	
Screening percentages[a]	**N**	**% (95% CI)**	***n***	**% (95% CI)**	***n***	**% (95% CI)**	**N**	**% (95% CI)**	***n***	**% (95% CI)**
Age, years										
Total	7,063	26.7 (25.5, 27.9)	5,145	30.9 (29.4, 32.5)	6,125	27.9 (26.6, 29.3)	8,691	23.6 (22.4, 24.8)	8,302	24.5 (23.1, 25.8)
40–54	3,577	14.3 (13.1, 15.6)	2,470	17.7 (16.1, 19.6)	2,918	14.2 (12.6, 15.9)	2,591	11.1 (9.9, 12.5)	2,155	12.5 (11.0, 14.1)
55–69	2,289	39.3 (36.9, 41.7)	1,807	43.1 (40.3, 46.1)	2,201	40.8 (38.4, 43.4)	5,221	32.8 (30.8, 34.7)	5,128	33.8 (31.3, 36.4)
≥70	1,197	45.8 (42.8, 48.8)	868	51.1 (47.3, 54.9)	1,006	45.8 (42.1, 49.6)	951	40.5 (37.0, 44.0)	1,019	36.4 (33.3, 39.6)
Adjusted screening[b] **rate ratios**		**2005**		**2008 vs 2005, RR (99% CI)**		**2010 vs 2008, RR (99% CI)**		**2013 vs 2010, RR (99% CI)**		**2015 vs 2013, RR (99% CI)**
Age, years		–								
40–54		–		**1.24 (1.03, 1.45)****		**0.80 (0.64, 0.96)****		**0.79 (0.62, 0.97)****		1.12 (0.88, 1.37)
55–69		–		1.10 (0.97, 1.23)		0.95 (0.83, 1.06)		**0.80 (0.71, 0.90)*****		1.03 (0.91, 1.13)
≥70		–		1.13 (0.98, 1.27)		0.89 (0.77, 1.02)		0.88 (0.74, 1.03)		0.90 (0.76, 1.05)

Note: Boldface indicates statistical significance (***p*<0.01; ****p*<0.001); *p*-value was derived from differences in predicted margins between each 2 consecutive years for each age group using logistic regression after adjusting for race. Questions about PSA testing were not included in NHIS survey years 2006, 2007, 2009, 2011, 2012, and 2014.

[a]Percentages are weighted to the study population in the respective year.

[b]Rate ratios (RR) are based on a comparison between each survey year and the prior survey year, and adjusted for race using logistic regression models with predicted marginal probabilities.

NHIS, National Health Interview Survey; PSA, prostate-specific antigen; RR, rate ratio.

Table 2.

Estimated Percentages of PSA Testing in the Past Year and Adjusted Rate Ratios by Risk Level and Survey Year

	NAA/NFH		AA/FH	
Screening percentages[a]	***n***	**% (95% CI)**	***n***	**% (95% CI)**
Survey year				
2005	5,615	27.8 (26.5, 29.2)	1,227	34.1 (31.2, 37.1)
2010	4,665	28.8 (27.4, 30.3)	1,290	30.8 (27.9, 33.8)
2015	6,669	23.1 (21.7, 24.5)	1,493	28.6 (25.8, 31.5)
Adjusted screening[b] **rate ratios**	**RR (99% CI)**		**RR (99% CI)**	
Survey year				
2005	-		-	
2010 vs 2005	1.05 (0.95, 1.15)		0.91 (0.75, 1.07)	
2015 vs 2010	0.82 (0.73, 0.90)		0.95 (0.77, 1.13)	

Note: NHIS survey years 2008 and 2013 are not shown because family history was not collected in those years.

[a]Percentages are weighted to the study population in the respective year and are standardized to the 2010 Census estimated population.

[b]Rate ratios (RR) are based on a comparison between each survey year and the prior survey year, and adjusted for age group and race using logistic regression models with predicted marginal probabilities.

AA/FH, African American/family history (higher risk); NAA/NFH, non-African American/no family history (average risk); NHIS, National Health Interview Survey; PSA, prostate-specific antigen; RR, rate ratio.